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**- Basic Estimated Capital Investment
and Operating Costs for Underground
Bituminous Coal Mines**

**Mines With Annual Production of 1.06 to 4.99
Million Tons From a 72-Inch Coalbed**

Revision of Information Circular 8632



UNITED STATES DEPARTMENT OF THE INTERIOR

United States Bureau of Mines

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By Sidney Katell, E. L. Hemingway, and L. H. Berkshire
Process Evaluation Group—MMRD, Morgantown, W. Va.



UNITED STATES DEPARTMENT OF THE INTERIOR

Thomas S. Kleppe, Secretary

BUREAU OF MINES

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BASIC ESTIMATED CAPITAL INVESTMENT AND OPERATING COSTS FOR UNDERGROUND BITUMINOUS COAL MINES

Mines With Annual Production of 1.06 to 4.99 Million Tons
From a 72-Inch Coalbed

Revision of Information Circular 8632

by

Sidney Katell,¹ E. L. Hemingway,² and L. H. Berkshire³

ABSTRACT

This study estimates capital investment, operating costs, and selling prices for four underground bituminous mines producing coal with annual production ranging from 1.06 to 4.99 million tons. It is assumed that the mines have a 20-year life. Wages and union welfare payments are considered as of December 6, 1974, under the Bituminous Wage Agreement of 1974, and costs for material and equipment are based on 1975 indexes.

Initial capital investment ranges from \$20,799,800 for the 1.06-million-ton-per-year (MM tpy) mine to \$84,027,500 for the 4.99-MM-tpy mine. Total capital investment ranges from \$32,506,800 to \$122,983,500 for the same mines. Corresponding selling prices for the coal range from \$12.87 to \$11.64 per ton, assuming a 15-percent discounted cash flow rate of return after Federal income taxes.

INTRODUCTION

Growing public concern about the increasing demand for energy has brought about a renewed interest in coal production in the United States. Because cost is an important factor in determining the extent to which coal will be used to satisfy this energy requirement, the Bureau of Mines is preparing a series of reports that provide estimated capital investment and operating costs for hypothetical mines that may be utilized in the production of synthetic fuels or for electric utility plants.

¹ Chief, Process Evaluation Group.

² Mining engineer.

³ Economist.

Three studies that presented capital investment and operating costs for coal mines, based on rates in effect under the Bituminous Wage Agreement of 1971, were published in 1974¹. This report is the first of a new series that updates the previous publications to reflect wage and union welfare rates, which went into effect December 6, 1974, under the Bituminous Wage Agreement of 1974. Costs for material and equipment are based on January 1975 cost indexes, and selling prices are based on a 15-percent discounted cash flow (DCF) rate of return after Federal income taxes. Mines are assumed to have a 20-year life.

This study presents basic capital investment and production costs for four hypothetical underground bituminous coal mines with a 72-inch working height and with annual production ranging from 1.06 to 4.99 million tons of coal. Since costs are affected by many factors, any particular mine, in reality, will have to be considered in relation to its own special situation and requirements.

This publication, Information Circular 8682A, modifies areas in which results of various calculations were carried forward incorrectly in Information Circular 8682.

GENERAL MINING PLAN

It is assumed that the mines operate 5 days per week, 220 days per year, and have a 20-year life. Continuous miner sections produce 344 tons of coal per unit per shift.

Acres of surface needed to produce the required tonnages are calculated assuming 1,800 tons of coal per acre-foot with 6 feet of mining height and 57-percent recovery. The following table shows the acreage requirements.

TABLE 1. - Acreage required to provide coal resources necessary to sustain a 20-year mining operation

Production, MM tpy	Acres required, 57-percent recovery
1.06	3,442
2.04	6,639
3.18	10,326
4.99	16,228

¹Katell, Sidney, and E. L. Hemingway. Basic Estimated Capital Investment and Operating Costs for Underground Bituminous Coal Mines: Mines With Annual Production of 1.06 to 4.99 Million Tons From a 72-Inch Coalbed. BuMines IC 8632, 1974, 41 pp.

_____. Basic Estimated Capital Investment and Operating Costs for Underground Bituminous Coal Mines: Mines With Annual Production of 1.03 to 3.09 Million Tons From a 48-Inch Coalbed. BuMines IC 8641, 1974, 31 pp.

_____. Basic Estimated Capital Investment and Operating Costs for Coal Strip Mines. BuMines IC 8661, 1974, 31 pp.

The general mining plan involves driving main entries along the center axis of the property with production headings on the right and left. In the 1.06- and 2.04-MM-tpy mines, all mining is concentrated on one side of the main heading, the plan being to mine one side of the main entries on the advance and the other side on the retreat. In the 3.18- and 4.99-MM-tpy mines, production headings were driven both ways off the main headings to reduce development time and to reach full production with the number of units required.

The main headings have 11 entries, and the production headings have 8 entries, 14 feet wide on 95-foot centers. The production panels are on the 8-entry system, 16 feet wide on 95-foot centers. Production panels are 2,600 feet long plus an additional length for development of the bleeder system. Figure 1 is a diagram of the general mining plan.

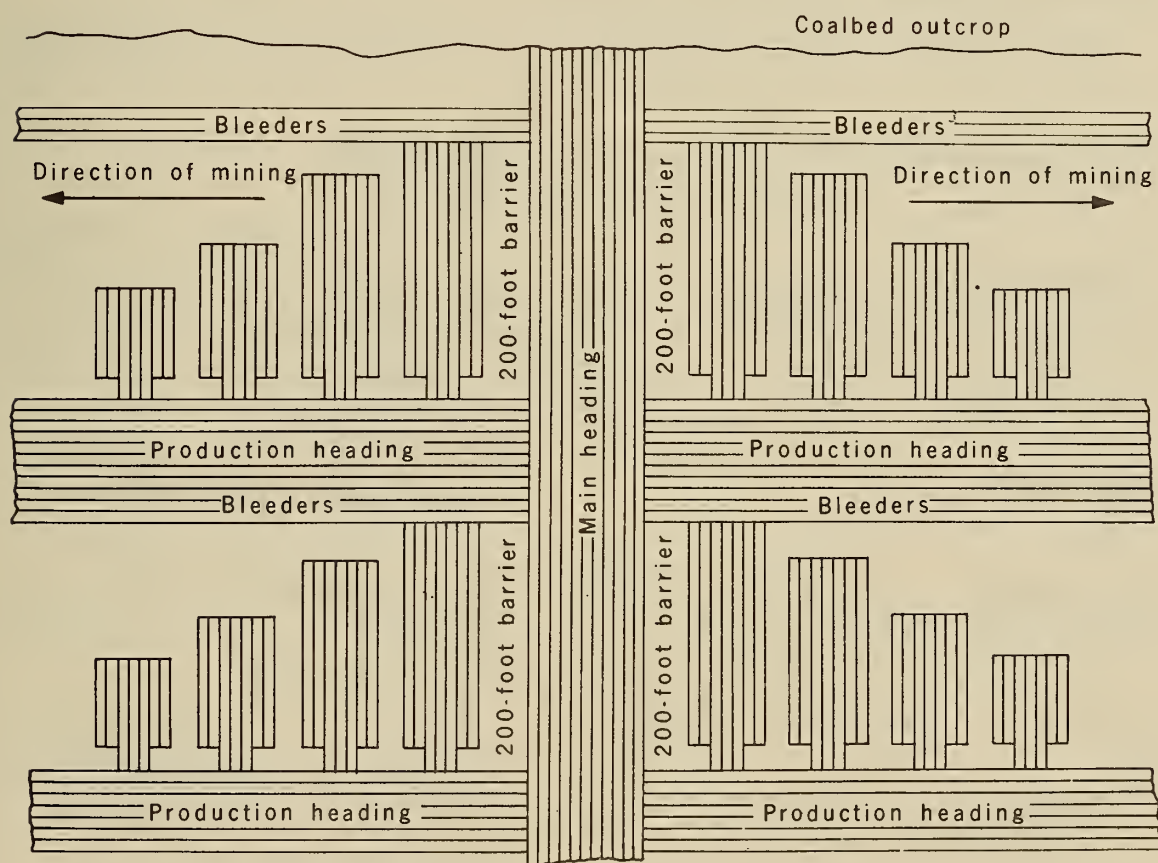


FIGURE 1. - General Mining plan.

Each loading unit will consist of a continuous miner, a loading machine, two shuttle cars, and a roof bolter. The shuttle cars will dump into a ratio feeder at the tailpiece of the unit belt conveyor. Unit manpower consists of 10 men and a foreman. Each unit is equipped with a power center to reduce high voltage to equipment requirements. A rectifier converts alternating current to direct current where necessary.

Coal is transported to the surface by belt conveyors. The main heading conveyors are 42 inches wide, and the production headings and panels are 36 inches wide.

The estimated development cost covers the period of time needed to establish the outside facilities and the time required to place all underground mining units in operation within the basic mining plan. Time needed to develop the surface area depends on topography and the location of existing roads, railroads, navigable rivers, or plant site. The development period was estimated conservatively at 1 year for the 1-MM-tpy mine, 1-1/2 years for the 2- and 3-MM-tpy mines, and 2 years for the 5-MM-tpy mine, but could vary with the location.

The following detailed equipment list describes the principal pieces of equipment that will be used in the mines:

Continuous miner

Hp: 600.

Drive: Motor.

Loading machine

Loading rate: 25/30 tons
per minute (tpm).

Hp: 160.

Drive: Motor.

Shuttle car

Hp: 135.

Drive: Motor.

Ratio feeder

Can accept 15+ tons of coal
discharge at desired rate.

Self-tramming.

Equipped with lumpster.

Auxiliary fan

To provide more effective
ventilation at working face.

Triple duty rock duster

To dust main heading, faces,
and back area.

Hp: 30.

Roof bolter

Dual boom.

Hp: 50.

Equipped with dust collector.

Supply motor

To haul supplies to working
faces.

Hp: 80.

Drive: Motor.

Mainline belt power center

300 kV-A.

Section belt power center

150 kV-A.

Section rectifier

200 kW.

Rectifier for track haulage

1,000 kW.

Main ventilation fan

Type: Dual.

Size: 8 ft.

350,000 cfm at 6-inch water
gauge.

Information supporting the cost figures in this study is included in tables that make up appendixes A, B, C, and D for the 1.06-, 2.04-, 3.18-, and 4.99-MM-tpy mines, respectively. The following tables are included for each of the mines.

Table No.

1	Capital investment summary
2	Manning table
3	Depreciation schedule
4	Power and water cost
5	Estimated annual production cost
6	Estimated development cost
7	Estimated working capital and total capital investment
8	Summary of discounted cash flow
9	Discounted cash flow

SUMMARY

This study furnishes cost analyses for four hypothetical underground bituminous mines that produce 1.06, 2.04, 3.18, and 4.99 million tons of coal per year. A summary of the total capital investments, operating costs, and selling prices is given in table 2.

TABLE 2. - Summary of estimated capital investment,
operating cost, and selling price
by annual output capacity

MM tpy.....	1.06	2.04	3.18	4.99
	Capital investment			
Initial.....	\$20,799,800	\$36,943,000	\$54,853,800	\$84,027,500
Deferred.....	11,707,000	18,615,000	26,164,500	38,956,000
Total....	32,506,800	55,558,000	81,018,300	122,983,500
Per ton of production..	30.67	27.23	25.48	24.65
	Production cost			
Per year.....	9,744,200	17,335,600	25,988,100	40,500,300
Per ton.....	9.19	8.50	8.18	8.12
	Selling price per ton			
12 percent DCF	11.92	11.15	10.74	10.71
15 percent DCF	12.87	12.08	11.63	11.64
20 percent DCF	14.49	13.68	13.17	13.25

APPENDIX A.--1.06-MM-TPY MINE

TABLE A-1. - Capital investment summary, 1.06-MM-tpy mine

Item	Quantity	Total cost
Continuous miner.....	6	\$1,809,600
Loading machine.....	6	483,800
Shuttle car.....	12	889,500
Roof bolter.....	8	426,000
Ratio feeder.....	6	270,000
Auxiliary fan.....	7	26,300
Mantrip Jeep ¹	6	105,000
Mechanic Jeep.....	3	41,300
Personnel Jeep.....	4	50,000
Trickle rock duster.....	8	35,000
Triple duty rock duster.....	7	271,000
Supply motor.....	3	94,000
Supply car.....	25	78,100
36-inch rope-type belt conveyor.....	25,740 ft	1,771,500
Mainline belt power center (300 kV-A)...	5	93,800
Section belt power center (150 kV-A)....	5	62,500
Section power center (1,000 kV-A).....	6	172,500
Section rectifier (200 kW).....	6	15,000
Section switch house.....	6	56,300
Sectionalizing switch house.....	7	65,600
High voltage (HV) cable (300 million circular mill aluminum {MCM AL}).....	12,000 ft	120,000
PLM ¹ coupler.....	15	14,600
Section cable and coupler.....	-	46,600
Rectifier for track haulage.....	1	25,000
Trolley wire.....	24,740 ft	77,400
Track (60-lb).....	24,740 ft	247,400
Fresh water lines.....	24,740 ft	92,800
Pumps and lines.....	-	19,000
Telephone (page phones).....	-	9,000
Conveyor fire protection.....	-	25,000
Automatic controls and alarms.....	-	50,000
Scoop tractor.....	7	245,000
Battery charger.....	7	26,200
All service mask.....	12	1,500
Breathing apparatus.....	12	9,400
Self rescuer.....	250	9,400
Stretcher set.....	8	1,300
Safety light.....	100	4,400
Methanometer.....	100	37,500
Fire chemical car.....	4	15,000
Lamp (including accessories).....	250	13,000
Dust sampler.....	20	7,500
Site preparation.....	-	40,000
Ventilation fan (dual).....	-	120,000

TABLE A-1. - Capital investment summary, 1.06-MM-tpy mine - Continued

Item	Quantity	Total cost
Concrete portal.....	5	75,000
Bulk rock dust facility.....	1	20,000
Substation and distribution.....	1	100,000
Bathhouse, office, and lamp house.....	1	350,000
Shop and warehouse.....	1	187,500
Powder and cap house.....	1	6,000
Front-end loader.....	1	63,000
Forklift.....	1	44,000
Bulldozer.....	1	100,000
Utility truck.....	1	9,000
Pickup truck.....	1	6,000
Oil storage.....	1	12,000
Water tank.....	1	12,000
Supply yard.....	1	15,000
Mine drainage treatment plant.....	-	37,500
Exploration.....	-	65,000
Total direct.....		9,175,800
Field indirect.....		183,500
Total construction.....		9,359,300
Engineering.....		187,200
Overhead and administration.....		477,300
		10,023,800
Contingency.....		1,503,600
		11,527,400
Fee.....		230,500
		11,757,900
Estimated development cost.....		8,593,700
		20,351,600
Interest during development.....		1,017,600
Gross estimate.....		21,369,200
Credit for coal mined during development at \$10 per ton		11,275,000
		10,094,200
Land acquired at \$2,500 per acre.....		8,600,000
Net estimate.....		18,694,200

¹Reference to specific trade names in this report is done to facilitate understanding and does not imply endorsement by the Bureau of Mines.

TABLE A-2. - Manning table, 1.06-MM-tpy mine

Personnel	Total	Wages ¹ per day	Cost per year	Cost per ton
Underground:				
Continuous miner operator...	14	\$55.00	\$172,128	
Loading machine operator....	14	51.98	162,826	
Machine operator helper.....	14	51.98	162,826	
Shuttle car operator.....	28	49.23	308,713	
Roof bolter.....	28	55.00	344,256	
Bratticeman.....	14	47.03	147,580	
Utility man.....	14	49.23	154,357	
Mechanic (section).....	14	55.00	172,128	
	<u>140</u>		<u>1,624,800</u>	\$1.53
Supply motorman.....	4	47.58	42,398	
Beltman.....	9	47.03	94,968	
Trackman.....	6	47.03	63,311	
Wireman.....	6	47.03	63,311	
Mason (precision).....	6	49.23	65,743	
Pumper.....	3	47.03	31,657	
Utility crew.....	9	49.23	99,324	
Roving mechanic.....	6	55.00	73,568	
Fireboss (union).....	3	55.00	36,916	
	<u>52</u>		<u>571,196</u>	.54
Outside:				
Lampman.....	3	45.38	30,568	
Front-end loader operator...	2	47.85	21,318	
Shop mechanic.....	6	49.50	66,572	
	<u>11</u>		<u>118,458</u>	.11
Salary:				
Superintendent.....	1	-	30,000	
General mine foreman.....	1	-	20,000	
Assistant mine foreman.....	3	-	48,000	
Section foreman.....	14	-	196,000	
Maintenance superintendent..	1	-	21,800	
General shop foreman.....	1	-	15,200	
Mine maintenance foreman....	3	-	45,000	
Chief mine engineer.....	1	-	22,500	
Draftsman.....	1	-	9,200	
Survey crew.....	3	-	29,700	
Safety director.....	1	-	19,800	
Safety inspector.....	3	-	43,500	
Dust sampler.....	3	-	31,500	
Office manager.....	1	-	15,800	
Timekeeper and bookkeeper...	1	-	11,000	
Purchasing supervisor.....	1	-	15,800	
Warehouseman.....	4	-	39,600	
	<u>43</u>		<u>614,400</u>	.58
Total labor and supervision...	<u>246</u>		<u>2,928,900</u>	<u>2.76</u>

¹Figures in this column are for the day shift. Shift differentials for other shifts are reflected in the cost per year.

TABLE A-3. - Depreciation schedule, 1.06-MM-tpy mine

Item	Straight-line depreciation, years	Yearly charge, dollars
Exploration.....	20	3,300
Mine drainage treatment plant.....	10	3,800
Supply yard.....	10	1,500
Water tank.....	10	1,200
Oil storage.....	10	1,200
Pickup truck.....	5	1,200
Utility truck.....	5	1,800
Bulldozer.....	10	10,000
Forklift.....	10	4,400
Front-end loader.....	10	6,300
Powder and cap house.....	10	600
Shop and warehouse.....	20	9,400
Bathhouse, office, and lamp house....	20	17,500
Substation.....	20	5,000
Bulk rock dust facility.....	10	2,000
Concrete portals.....	20	3,800
Ventilation fan.....	20	6,000
Site preparation.....	20	2,000
Coal mine safety equipment.....	5	29,800
Underground equipment.....	10	776,500
Interim equipment replacement.....	20	157,000
Subtotal.....		1,044,300
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, cost of development, and interest during development, less credit for coal mined at \$10 per ton.....	20	45,900
Total.....		¹ 1,090,200

¹\$1.03 per ton.

TABLE A-4. - Power and water cost, 1.06-MM-tpy mine

Number of units	Operation	Hp per unit	Hp, total load	Hr per day, full load	KW, total load	Total kW-hr requirement
5	Continuous miner..	600	3,000	10	2,238	22,380
4	Continuous miner..	600	2,400	5	1,790	8,950
5	Loading machine...	160	800	10	597	5,970
4	Loading machine...	160	640	5	477	2,385
10	Shuttle car.....	135	1,350	10	1,007	10,070
8	Shuttle car.....	135	1,080	5	806	4,030
5	Roof bolter.....	50	250	12	187	2,244
4	Roof bolter.....	50	200	6	149	894
5	Ratio feeder.....	125	625	10	466	4,660
4	Ratio feeder.....	125	500	5	373	1,865
5	Auxiliary fan.....	30	150	18	112	2,016
5	Mantrip Jeep.....	15	75	4	56	224
4	Mantrip Jeep.....	15	60	2	45	90
3	Mechanic Jeep.....	15	45	15	34	510
4	Personnel Jeep....	7.5	30	15	22	330
7	Rock duster.....	30	210	12	157	1,884
3	Supply motor.....	80	240	12	179	2,148
10	36-inch conveyor..		850	15	634	9,510
1	Ventilation fan...		500	24	373	8,952
	Extra for pumps, tools, lights, etc.		400	10	298	2,980
Total.....						92,092

NOTE. - Power: $\$0.02 \times 92,092 \times 220 = \$405,200 \div 1,059,500$
 $= \$0.38$ per ton.

Water: 3,000 gal per unit per shift at \$0.10 per M gal
 $= 3,000 \times 14 \times 220 \times 0.10 \div 1,000 = \$900.$

TABLE A-5. - Estimated annual production cost, 1.06-MM-tpy mine

	Annual cost	Cost per ton
Direct cost:		
Production:		
Labor.....	\$2,002,200	\$1.89
Supervision.....	532,400	.50
	<u>2,534,600</u>	<u>2.39</u>
Maintenance:		
Labor.....	312,300	.29
Supervision.....	82,000	.08
	<u>394,300</u>	<u>.37</u>
Operating supplies:		
Mining machine parts.....	669,800	.63
Lubrication and hydraulic oil.....	266,000	.25
Roof bolts and timber.....	328,600	.31
Rock dust.....	139,800	.13
Ventilation.....	201,400	.19
Bits.....	127,200	.12
Cables.....	63,600	.06
Miscellaneous.....	159,000	.15
	<u>1,955,400</u>	<u>1.84</u>
Power.....	405,200	.38
Water.....	900	
Payroll overhead (40 percent of payroll)...	1,171,600	1.11
Union welfare ¹	1,105,900	1.05
Indirect cost:		
15 percent of labor, supervision, and supplies.....	732,600	.69
Fixed cost:		
Taxes and insurance, 2 percent of mine cost.....	353,500	.33
Depreciation.....	1,090,200	1.03
	<u>1,443,700</u>	<u>1.36</u>
Total.....	<u>9,744,200</u>	<u>9.19</u>

¹Effective Dec. 6, 1974, under the Bituminous Wage Agreement of 1974.

TABLE A-6. - Estimated development cost¹, 1.06-MM-tpy mine

Item	Total cost	Cost per ton
Total labor and supervision.....	\$3,166,600	\$2.81
Operating supplies.....	1,296,600	1.15
Power.....	281,900	.25
Payroll overhead.....	1,266,600	1.12
Union welfare.....	1,172,600	1.04
Indirect cost.....	654,000	.58
Fixed cost.....	755,400	.67
Total.....	8,593,700	7.62

¹Estimated development cost covers the period of time required to place all units in operation within the projected mining plan.

NOTE. - Cost per ton = \$7.62.

Tonnage = 1,127,500.

Credit for coal mined at \$10 per ton = \$11,275,000.

TABLE A-7. - Estimated working capital and total capital investment,
1.06-MM-tpy mine

Estimated working capital:

Direct labor.....	3 months...	\$732,200
Operating supplies.....	3 months...	488,900
Payroll overhead.....	3 months...	292,900
Indirect cost.....	4 months...	244,200
Fixed cost.....	0.5 percent of insurance base...	88,400
Spare parts.....		230,000
Miscellaneous.....		29,000
Total working capital.....		2,105,600

Total estimated capital investment:

Total mine cost (insurance, tax base).....	17,676,600
Interest during development.....	1,017,600
Subtotal.....	18,694,200
Working capital.....	2,105,600
Estimated capital investment.....	20,799,800
Estimated deferred capital investment.....	11,707,000
Total capital investment and deferred investment...	32,506,800

¹This is an average cost of \$30.67 per ton of annual production.

TABLE A-8. - Summary of discounted cash flow, 1.06-MM-tpy mine

Year	Capital investment	Cash flow	Present worth factor at 15 percent	Present worth capital investment at 15 percent	Present worth cash flow value at 15 percent
0	\$20,799,800	\$-20,799,800	1.	\$20,799,800	\$-20,799,800
1	157,000	3,560,300	.8696	136,500	3,096,000
2	157,000	3,560,300	.7561	118,700	2,691,900
3	157,000	3,560,300	.6575	103,200	2,340,900
4	157,000	3,560,300	.5718	89,800	2,035,800
5	321,000	3,396,300	.4972	159,600	1,688,600
6	157,000	3,560,300	.4323	67,900	1,539,100
7	157,000	3,560,300	.3759	59,000	1,338,300
8	157,000	3,560,300	.3269	51,300	1,163,900
9	157,000	3,560,300	.2843	44,600	1,012,200
10	8,396,000	-4,678,700	.2472	2,075,500	-1,156,600
11	157,000	3,560,300	.2149	33,700	765,100
12	157,000	3,560,300	.1869	29,300	665,400
13	157,000	3,560,300	.1625	25,500	578,500
14	157,000	3,560,300	.1413	22,200	503,100
15	321,000	3,396,300	.1229	39,500	417,400
16	157,000	3,560,300	.1069	16,800	380,600
17	157,000	3,560,300	.0929	14,600	330,800
18	157,000	3,560,300	.0808	12,700	287,700
19	157,000	3,560,300	.0703	11,000	250,300
20	-10,548,600	14,265,900	.0611	-644,500	871,600
				23,266,700	.800

TABLE A-9. - Discounted cash flow, 1.06-MM-tpy mine

15 percent - 20 years

$$R = \$23,266,700 \div 6.259^1 = \$3,717,300$$

$$\text{less depreciation} \quad \underline{1,090,200}$$

$$\text{Depletion + net profit} = \underline{2,627,100}$$

Depletion = 10 percent of sales

Federal income tax = net profit

Depletion + net profit = cash flow - depreciation

$$\text{Sales} = 1/0.55 (1/2 \text{ operating cost} + \text{cash flow} - \text{depreciation})$$

$$= 1/0.55 (4,872,100 + 2,627,100)$$

Sales.....	\$13,634,900
Operating cost.....	<u>9,744,200</u>
Gross profit.....	3,890,700
Depletion.....	<u>1,363,500</u>
Taxable income.....	2,527,200
Federal income tax.....	<u>1,263,600</u>
Net profit.....	<u>1,263,600</u>

$$\text{Annual cash flow} = \text{net profit} + \text{depreciation} + \text{depletion}$$

$$= \$1,263,600 + \$1,090,200 + \$1,363,500$$

$$= \$3,717,300$$

$$\text{Selling price per ton} = \$13,634,900 \div 1,059,500 = \$12.87$$

¹Uniform series present worth factor.

APPENDIX B.--2.04-MM-TPY MINE

TABLE B-1. - Capital investment summary, 2.04-MM-tpy mine

Item	Quantity	Total cost
Continuous miner.....	11	\$3,317,600
Loading machine.....	11	886,600
Shuttle car.....	22	1,630,200
Roof bolter.....	13	692,900
Ratio feeder.....	11	495,000
Auxiliary fan.....	13	49,400
Mantrip Jeep.....	9	157,500
Mechanic Jeep.....	4	55,200
Personnel Jeep.....	6	75,000
Trickle rock duster.....	14	61,600
Triple duty rock duster.....	12	466,800
Supply motor.....	5	156,500
Supply car.....	50	155,000
42-inch rope-type mainline belt conveyor.....	9,000 ft	720,000
36-inch rope-type belt conveyor.....	26,561 ft	1,832,700
Mainline belt power center (300 kV-A).....	5	95,000
Section belt power center (150 kV-A).....	7	87,500
Section power center (1,000 kV-A).....	11	316,300
Section rectifier (200 kW).....	11	27,500
Section switch house.....	11	103,100
Sectionalizing switch house.....	10	93,800
HV cable (300 MCM AL).....	13,100 ft	131,000
PLM coupler.....	17	16,600
Section cable and coupler.....	-	85,300
Rectifier for track haulage.....	2	50,000
Trolley wire.....	31,300 ft	98,600
Track (60-lb).....	31,300 ft	313,000
Fresh water line.....	31,300 ft	117,400
Pumps and lines.....	-	25,000
Telephone (page phones).....	-	10,000
Conveyor fire protection.....	-	27,500
Automatic controls and alarms.....	-	75,000
Scoop tractor.....	12	375,000
Battery charger.....	12	30,000
All service mask.....	36	4,500
Breathing apparatus.....	24	18,800
Self rescuer.....	450	16,900
Stretcher set.....	12	1,900
Safety light.....	200	8,800
Methanometer.....	200	75,000
Fire chemical car.....	8	30,000
Lamp (including accessories).....	450	23,600
Dust sampler.....	35	13,100
Site preparation.....	-	37,500
Ventilation fan (dual).....	-	115,000

TABLE B-1. - Capital investment summary, 2.04-MM-tpy mine - Continued

Item	Quantity	Total cost
Concrete portal.....	5	87,500
Bulk rock dust facility.....	1	25,000
Substation and distribution.....	1	87,500
Bathhouse, office, and lamp house.....	1	390,000
Shop and warehouse.....	1	250,000
Powder and cap house.....	1	7,500
Front-end loader.....	1	62,500
Forklift.....	1	25,000
Bulldozer.....	1	100,000
Utility truck.....	1	5,000
Pickup truck.....	1	3,800
Oil storage.....	1	18,800
Water tank.....	1	18,800
Supply yard.....	1	18,800
Mine drainage treatment plant.....	-	37,500
Exploration.....	-	125,000
Total direct.....		14,437,400
Field indirect.....		288,700
Total construction.....		14,726,100
Engineering.....		294,500
Overhead and administration.....		751,000
		15,771,600
Contingency.....		2,365,700
		18,137,300
Fee.....		362,700
		18,500,000
Estimated development cost.....		11,795,900
		30,295,900
Interest during development.....		1,514,800
Gross estimate.....		31,810,700
Credit for coal mined during development at \$10 per ton.		15,251,000
		16,559,700
Land acquired at \$2,500 per acre.....		16,597,500
Net estimate.....		33,157,200

TABLE B-2. - Manning table, 2.04-MM-tpy mine

Personnel	Total	Wages ¹ per day	Cost per year	Cost per ton
Underground:				
Continuous miner operator..	27	\$55.00	\$332,244	
Loading machine operator...	27	51.98	314,304	
Machine operator helper....	27	51.98	314,304	
Shuttle car operator.....	54	49.23	595,941	
Roof bolter.....	54	55.00	664,488	
Bratticeman.....	27	47.03	284,901	
Utility man.....	27	49.23	297,971	
Mechanic (section).....	27	55.00	332,244	
	270		3,136,397	\$1.54
Supply motorman.....	6	47.58	64,037	
Beltman.....	18	47.03	189,936	
Trackman.....	9	47.03	94,968	
Wireman.....	9	47.03	94,968	
Mason (precision).....	12	49.23	132,430	
Pumper.....	3	47.03	31,657	
Utility crew.....	18	49.23	198,648	
Roving mechanic.....	9	55.00	110,748	
Fireboss (union).....	3	55.00	36,916	
	87		954,308	.47
Outside:				
Lampman.....	3	45.38	30,568	
Front-end loader operator..	3	47.85	32,197	
Shop mechanic.....	9	49.50	99,858	
	15		162,623	.08
Salary:				
Superintendent.....	1	-	30,000	
General mine foreman.....	1	-	20,000	
Assistant mine foreman.....	3	-	48,000	
Section foreman.....	27	-	378,000	
Maintenance superintendent.	1	-	21,800	
General shop foreman.....	1	-	15,200	
Mine maintenance foreman...	3	-	45,000	
Chief mine engineer.....	1	-	22,500	
Draftsman.....	1	-	9,200	
Survey crew.....	3	-	29,700	
Safety director.....	1	-	19,800	
Safety inspector.....	3	-	43,500	
Dust sampler.....	3	-	31,500	
Office manager.....	1	-	15,800	
Timekeeper and bookkeeper..	1	-	11,000	
Purchasing supervisor.....	1	-	15,800	
Warehouseman.....	4	-	39,600	
	56		796,400	.39
Total labor and supervision	428		5,049,700	2.48

¹Figures in this column are for the day shift. Shift differentials for other shifts are reflected in the cost per year.

TABLE B-3. - Depreciation schedule, 2.04-MM-tpy mine

Item	Straight-line depreciation, years	Yearly charge, dollars
Exploration.....	20	6,300
Mine drainage treatment plant.....	10	3,800
Supply yard.....	10	1,900
Water tank.....	10	1,900
Oil storage.....	10	1,900
Pickup truck.....	5	800
Utility truck.....	5	1,000
Bulldozer.....	10	10,000
Forklift.....	10	2,500
Front-end loader.....	10	6,300
Powder and cap house.....	10	800
Shop and warehouse.....	20	12,500
Bathhouse, office, and lamp house....	20	19,500
Substation.....	20	4,400
Bulk rock dust facility.....	10	2,500
Concrete portals.....	20	4,400
Ventilation fan.....	20	5,800
Site preparation.....	20	1,900
Coal mine safety equipment.....	5	59,000
Underground equipment.....	10	1,272,700
Interim equipment replacement.....	20	233,000
Subtotal.....		1,652,900
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, cost of development, and interest during development, less credit for coal mined at \$10 per ton.....	20	106,100
Total.....		¹ 1,759,000

¹\$0.86 per ton.

TABLE B-4. - Power and water cost, 2.04-MM-tpy-mine

Number of units	Operation	Hp per unit	Hp, Total load	Hr per day, full load	KW, total load	Total kW-hr requirement
9	Continuous miner..	600	5,400	15	4,028	60,420
9	Loading machine...	160	1,440	15	1,074	16,110
18	Shuttle car.....	135	2,430	15	1,813	27,195
9	Roof bolter.....	50	450	18	336	6,048
9	Ratio feeder.....	125	1,125	15	839	12,585
9	Auxiliary fan.....	30	270	18	201	3,618
9	Mantrip Jeep.....	15	135	6	101	606
4	Mechanic Jeep.....	15	60	15	45	675
6	Personnel Jeep....	7.5	45	15	34	510
9	Rock duster.....	30	270	12	201	2,412
5	Supply motor.....	80	400	12	298	3,576
3	42-inch conveyor..	125	375	15	280	4,200
2	36-inch conveyor..	100	200	15	149	2,235
7	36-inch conveyor..	50	350	15	261	3,915
1	Ventilation fan...		500	24	373	8,952
	Extra for pumps, tools, lights, etc.		500	10	373	3,730
Total						156,787

NOTE. - Power: $\$0.02 \times 156,787 \times 220 = \$689,900 \div 2,043,400$
 $= \$0.34$ per ton.

Water: 3,000 gal per unit per shift at \$0.10 per M gal
 $= 3,000 \times 27 \times 220 \times 0.10 \div 1,000 = \$1,800.$

TABLE B-5. - Estimated annual production cost, 2.04-MM-tpy mine

	Annual cost	Cost per ton
Direct cost:		
Production:		
Labor.....	\$3,710,500	\$1.82
Supervision.....	714,400	.35
	<u>4,424,900</u>	<u>2.17</u>
Maintenance:		
Labor.....	542,800	.27
Supervision.....	82,000	.04
	<u>624,800</u>	<u>.31</u>
Operating supplies:		
Mining machine parts.....	1,287,300	.63
Lubrication and hydraulic oil.....	510,800	.25
Roof bolts and timber.....	633,500	.31
Rock dust.....	265,600	.13
Ventilation.....	388,200	.19
Bits.....	245,200	.12
Cables.....	122,600	.06
Miscellaneous.....	306,500	.15
	<u>3,759,700</u>	<u>1.84</u>
Power.....	689,900	.34
Water.....	1,800	
Payroll overhead (40 percent of payroll)...	2,019,900	.99
Union welfare ¹	2,101,400	1.03
Indirect cost:		
15 percent of labor, supervision, and supplies.....	1,321,400	.65
Fixed cost:		
Taxes and insurance, 2 percent of mine cost.....	632,800	.31
Depreciation.....	1,759,000	.86
	<u>2,391,800</u>	<u>1.17</u>
Total.....	<u>17,335,600</u>	<u>8.50</u>

¹Effective Dec. 6, 1974, under the Bituminous Wage Agreement of 1974.

TABLE B-6. - Estimated development cost¹, 2.04-MM-tpy mine

Item	Total cost	Cost per ton
Total labor and supervision.....	\$4,505,800	\$2.95
Operating supplies.....	1,753,900	1.15
Power.....	381,300	.25
Payroll overhead.....	1,708,100	1.12
Union welfare.....	1,570,900	1.03
Indirect cost.....	884,600	.58
Fixed cost.....	991,300	.65
Total.....	11,795,900	7.73

¹Estimated development cost covers the period of time required to place all units in operation within the projected mining plan.

NOTE. - Cost per ton = \$7.73.

Tonnage = 1,525,100.

Credit for coal mined at \$10 per ton = \$15,251,000.

TABLE B-7. - Estimated working capital and total capital investment,
2.04-MM-tpy mine

Estimated working capital:

Direct labor.....	3 months...	\$1,262,400
Operating supplies.....	3 months...	939,900
Payroll overhead.....	3 months...	505,000
Indirect cost.....	4 months...	440,500
Fixed cost.....	0.5 percent of insurance base...	158,200
Spare parts.....		424,800
Miscellaneous.....		55,000
Total working capital.....		3,785,800

Total estimated capital investment:

Total mine cost (insurance, tax base).....	31,642,400
Interest during development.....	1,514,800
Subtotal.....	33,157,200
Working capital.....	3,735,800
Estimated capital investment.....	36,943,000
Estimated deferred capital investment.....	18,615,000
Total capital investment and deferred investment...	155,558,000

¹This is an average cost of \$27.23 per ton of annual production.

TABLE B-8. - Summary of discounted cash flow, 2.04-MM-tpy mine

Year	Capital investment	Cash flow	Present worth factor at 15 percent	Present worth capital investment at 15 percent	Present worth cash flow value at 15 percent
-1/2	\$14,777,200	\$-14,777,200	1.07238	\$15,846,800	\$-15,846,800
0	22,165,800	-22,165,800	1.	22,165,800	-22,165,800
1	233,000	6,432,300	.8696	202,600	5,593,500
2	233,000	6,432,300	.7561	176,200	4,863,500
3	233,000	6,432,300	.6575	153,200	4,229,200
4	233,000	6,432,300	.5718	133,200	3,678,000
5	537,000	6,128,300	.4972	267,000	3,047,000
6	233,000	6,432,300	.4323	105,400	2,780,700
7	233,000	6,432,300	.3759	87,600	2,417,900
8	233,000	6,432,300	.3269	76,200	2,102,700
9	233,000	6,432,300	.2843	66,200	1,828,700
10	13,580,000	-6,914,700	.2472	3,357,000	-1,709,300
11	233,000	6,432,300	.2149	50,100	1,382,300
12	233,000	6,432,300	.1869	43,500	1,202,200
13	233,000	6,432,300	.1625	37,900	1,045,200
14	233,000	6,432,300	.1413	32,900	908,900
15	537,000	6,128,300	.1229	66,000	753,200
16	233,000	6,432,300	.1069	24,900	687,600
17	233,000	6,432,300	.0929	21,600	597,600
18	233,000	6,432,300	.0808	18,800	519,700
19	233,000	6,432,300	.0703	16,400	452,200
20	-20,150,300	26,815,600	.0611	-1,231,200	1,638,400
				41,718,100	6,600

TABLE B-9. - Discounted cash flow, 2.04-MM-tpy mine

15 percent - 20 years

$$\begin{aligned}
 R &= \$41,718,100 \div 6.259^1 = \$6,665,300 \\
 &\quad \text{less depreciation} \quad \underline{1,759,000} \\
 \text{Depletion + net profit} &= \underline{4,906,300}
 \end{aligned}$$

Depletion = 10 percent of sales

Federal income tax = net profit

Depletion + net profit = cash flow - depreciation

$$\begin{aligned}
 \text{Sales} &= 1.0/0.55 (1/2 \text{ operating cost} + \text{cash flow} - \text{depreciation}) \\
 &= 1/0.55 (8,667,800 + 4,906,300)
 \end{aligned}$$

Sales.....	\$24,680,200
Operating cost.....	<u>17,335,600</u>
Gross profit.....	7,344,600
Depletion.....	<u>2,468,000</u>
Taxable income.....	4,876,600
Federal income tax.....	<u>2,438,300</u>
Net profit.....	2,438,300

$$\begin{aligned}
 \text{Annual cash flow} &= \text{net profit} + \text{depreciation} + \text{depletion} \\
 &= \$2,438,300 + \$1,759,000 + \$2,468,000 \\
 &= \$6,665,300
 \end{aligned}$$

$$\text{Selling price per ton} = \$24,680,000 \div 2,043,400 = \$12.08$$

¹Uniform series present worth factor.

APPENDIX C.--3.18-MM-TPY MINE

TABLE C-1. - Capital investment summary, 3.18-MM-tpy mine

Item	Quantity	Total cost
Continuous miner.....	17	\$5,127,200
Loading machine.....	17	1,370,200
Shuttle car.....	34	2,519,400
Roof bolter.....	17	906,100
Ratio feeder.....	17	765,000
Auxiliary fan.....	17	64,600
Mantrip Jeep.....	17	297,500
Mechanic Jeep.....	6	82,800
Personnel Jeep.....	8	100,000
Trickle rock duster.....	17	74,800
Triple duty rock duster.....	13	503,100
Supply motor.....	6	187,800
Supply car.....	70	217,000
42-inch rope-type mainline conveyor belt....	9,000 ft	720,000
36-inch rope-type secondary and panel belt...	36,000 ft	2,412,000
Mainline belt power center (300 kV-A).....	6	112,800
Section belt power center (150 kV-A).....	14	175,000
Section power center (1,000 kV-A).....	17	489,600
Section rectifier (200 kW).....	17	42,500
Section switch house.....	17	159,800
Sectionalizing switch house.....	10	94,000
HV cable (300 MCM AL).....	16,000 ft	160,000
PLM coupler.....	18	18,000
Section cable and coupler.....	-	89,300
Rectifier for track haulage.....	3	75,000
Trolley wire.....	51,000 ft	159,600
Track (60-lb).....	51,000 ft	510,000
Fresh water line.....	51,000 ft	191,300
Pumps and lines.....	-	31,300
Telephone (page phones).....	-	11,300
Conveyor fire protection.....	-	30,000
Automatic controls and alarms.....	-	93,800
Scoop tractor.....	17	595,000
Battery charger.....	17	62,900
All service mask.....	36	3,600
Breathing apparatus.....	36	28,800
Self rescuer.....	650	24,400
Stretcher set.....	20	4,000
Safety light.....	300	13,200
Methanometer.....	300	120,000
Fire chemical car.....	10	38,000
Lamp (including accessories).....	650	33,800
Dust sampler.....	50	20,000
Site preparation.....	-	50,000
Ventilation fan (dual).....	-	120,000

TABLE C-1. - Capital investment summary, 3.18-MM-tpy mine - Continued

Item	Quantity	Total cost
Concrete portal.....	5	75,000
Bulk rock dust facility.....	1	37,500
Substation and distribution.....	1	93,800
Bathhouse, office, and lamp house.....	1	500,000
Shop and warehouse.....	1	312,500
Powder and cap house.....	1	8,800
Front-end loader.....	1	63,000
Forklift.....	1	44,000
Bull dozer.....	1	100,000
Utility truck.....	2	18,000
Pickup truck.....	2	12,000
Oil storage.....	1	25,000
Water tank.....	1	25,000
Supply yard.....	1	18,800
Mine drainage treatment plant.....	-	37,500
Exploration.....	-	187,500
Total direct.....		20,462,900
Field indirect.....		409,300
Total construction.....		20,872,200
Engineering.....		417,400
Overhead and administration.....		1,064,500
		22,354,100
Contingency.....		3,353,100
		25,707,200
Fee.....		514,100
		26,221,300
Estimated development cost.....		15,940,100
		42,161,400
Interest during development.....		2,108,100
Gross estimate.....		44,269,500
Credit for coal mined during development at \$10 per ton		20,946,000
		23,323,500
Land acquired at \$2,500 per acre.....		25,815,000
		<u>25,815,000</u>
Net estimate.....		49,138,500

TABLE C-2. - Manning table, 3.18-MM-tpy mine

Personnel	Total	Wages ¹ per day	Cost per year	Cost per ton
Underground:				
Continuous miner operator....	42	\$55.00	\$516,824	
Loading machine operator.....	42	51.98	488,918	
Machine operator helper.....	42	51.98	488,918	
Shuttle car operator.....	84	49.23	927,019	
Roof bolter.....	84	55.00	1,033,648	
Bratticeman.....	42	47.03	443,180	
Utility man.....	42	49.23	463,510	
Mechanic (section).....	42	55.00	516,824	
	420		4,878,841	\$1.53
Supply motorman.....	12	47.58	128,074	
Beltman.....	27	47.03	284,901	
Trackman.....	12	47.03	126,904	
Wireman.....	12	47.03	126,904	
Mason (precision).....	18	49.23	198,648	
Pumper.....	3	47.03	31,657	
Utility crew.....	24	49.23	264,863	
Roving mechanic.....	12	55.00	147,136	
Fireboss (union).....	4	55.00	73,832	
	124		1,382,919	.44
Outside:				
Lampman.....	3	45.38	30,568	
Front-end loader operator....	3	47.85	32,197	
Shop mechanic.....	12	49.50	133,144	
	18		195,909	.06
Salary:				
Superintendent.....	1	-	30,000	
General mine foreman.....	1	-	20,000	
Assistant mine foreman.....	3	-	48,000	
Section foreman.....	42	-	588,000	
Maintenance superintendent...	1	-	21,800	
General shop foreman.....	1	-	15,200	
Mine maintenance foreman.....	3	-	45,000	
Chief mine engineer.....	1	-	22,500	
Draftsman.....	1	-	9,200	
Survey crew.....	3	-	29,700	
Safety director.....	1	-	19,800	
Safety inspector.....	3	-	43,500	
Dust sampler.....	3	-	31,500	
Office manager.....	1	-	15,800	
Timekeeper and bookkeeper....	1	-	11,000	
Purchasing supervisor.....	1	-	15,800	
Warehouseman.....	4	-	39,600	
	71		1,006,400	.32
Total labor and supervision.	633		7,464,100	2.35

¹Figures in this column are for the day shift. Shift differentials for other shifts are reflected in the cost per year.

TABLE C-3. - Depreciation schedule, 3.18-MM-tpy mine

Item	Straight-line depreciation, years	Yearly charge, dollars
Exploration.....	20	9,400
Mine drainage treatment plant.....	10	3,800
Supply yard.....	10	1,900
Water tank.....	10	2,500
Oil storage.....	10	2,500
Pickup truck.....	5	2,400
Utility truck.....	5	3,600
Bulldozer.....	10	10,000
Forklift.....	10	4,400
Front-end loader.....	10	6,300
Powder and cap house.....	10	900
Shop and warehouse.....	20	15,600
Bathhouse, office, and lamp house....	20	25,000
Substation.....	20	4,700
Bulk rock dust facility.....	10	3,800
Concrete portals.....	20	3,800
Ventilation fan.....	20	6,000
Site preparation.....	20	2,500
Coal mine safety equipment.....	5	81,900
Underground equipment.....	10	1,832,500
Interim equipment replacement.....	20	308,000
Subtotal.....		2,331,500
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, cost of development, and interest during development, less credit for coal mined at \$10 per ton.....	20	143,000
Total.....		12,474,500

¹\$0.78 per ton.

TABLE C-4. - Power and water cost, 3.18-MM-tpy mine

Number of units	Operation	Hp per unit	Hp, total load	Hr per day, full load	KW, total load	Total kW-hr requirement
14	Continuous miner....	600	8,400	15	6,266	93,990
14	Loading machine.....	160	2,240	15	1,671	25,065
28	Shuttle car.....	135	3,780	15	2,820	42,300
14	Roof bolter.....	50	700	18	522	9,396
14	Ratio feeder.....	125	1,750	15	1,305	19,575
14	Auxiliary fan.....	30	420	18	313	5,634
14	Mantrip Jeep.....	15	210	6	156	936
6	Mechanic Jeep.....	15	90	15	67	1,005
8	Personnel Jeep.....	7.5	60	15	45	675
14	Rock duster.....	30	420	12	313	3,756
6	Supply motor.....	80	480	12	358	4,296
3	42-inch conveyor....	200	600	15	447	6,705
12	36-inch conveyor....	150	750	15	560	8,400
1	Ventilation fan.....		500	24	373	8,952
	Extra for pumps, tools, lights, etc.		500	10	373	3,730
Total.....						234,415

NOTE. - Power: $\$0.02 \times 234,415 \times 220 = \$1,031,400 \div 3,178,600$
 $= \$0.32$ per ton.

Water: 3,000 gal per unit per shift at $\$0.10$ per M gal
 $= 3,000 \times 14 \times 3 \times 220 \times 0.10 \div 1,000 = \$2,800.$

TABLE C-5. - Estimated annual production cost, 3.18-MM-tpy mine

	Annual cost	Cost per ton
Direct cost:		
Production:		
Labor.....	\$5,660,600	\$1.78
Supervision.....	924,400	.29
	<u>6,585,000</u>	<u>2.07</u>
Maintenance:		
Labor.....	797,100	.25
Supervision.....	82,000	.03
	<u>879,100</u>	<u>.28</u>
Operating supplies:		
Mining machine parts.....	2,002,500	.63
Lubrication and hydraulic oil.....	794,700	.25
Rock bolts and timber.....	985,400	.31
Rock dust.....	413,200	.13
Ventilation.....	604,900	.19
Bits.....	381,400	.12
Cables.....	190,700	.06
Miscellaneous.....	476,800	.15
	<u>5,849,600</u>	<u>1.84</u>
Power.....	1,031,400	.32
Water.....	2,800	
Payroll overhead (40 percent of payroll)...	2,985,600	.94
Union welfare ¹	3,242,400	1.02
Indirect cost:		
15 percent of labor, supervision, and supplies.....	1,997,100	.63
Fixed cost:		
Taxes and insurance, 2 percent of mine cost.....	940,600	.30
Depreciation.....	2,474,500	.78
	<u>3,415,100</u>	<u>1.08</u>
Total.....	<u>25,988,100</u>	<u>8.18</u>

¹Effective Dec. 6, 1974, under the Bituminous Wage Agreement of 1974.

TABLE C-6. - Estimated development cost¹, 3.18-MM-tpy mine

Item	Total cost	Cost per ton
Total labor and supervision.....	\$5,906,800	\$2.82
Operating supplies.....	2,408,800	1.15
Power.....	523,700	.25
Payroll overhead.....	2,346,000	1.12
Union welfare.....	2,178,400	1.04
Indirect cost.....	1,214,900	.58
Fixed cost.....	1,361,500	.65
Total.....	15,940,100	7.61

¹Estimated development cost covers the period of time required to place all units in operation within the projected mining plan.

NOTE. - Cost per ton = \$7.61.

Tonnage = 2,094,600.

Credit for coal mined at \$10 per ton = \$20,946,000.

TABLE C-7. - Estimated working capital and total capital investment,
3.18-MM-tpy mine

Estimated working capital:

Direct labor.....	3 months...	\$1,866,000
Operating supplies.....	3 months...	1,462,400
Payroll overhead.....	3 months...	746,400
Indirect cost.....	4 months...	665,800
Fixed cost.....	0.5 percent of insurance base...	235,200
Spare parts.....		653,200
Miscellaneous.....		86,300
Total working capital.....		5,715,300

Total estimated capital investment:

Total mine cost (insurance, tax base).....	47,030,400
Interest during development.....	2,108,100
Subtotal.....	49,138,500
Working capital.....	5,715,300
Estimated capital investment.....	54,853,800
Estimated deferred capital investment.....	26,164,500
Total capital investment and deferred investment....	¹ 81,018,300

¹This is an average cost of \$25.48 per ton of annual production.

TABLE C-8. - Summary of discounted cash flow, 3.18-MM-tpy mine

Year	Capital investment	Cash flow	Present worth factor at 15 percent	Present worth capital investment at 15 percent	Present worth cash flow value at 15 percent
-1/2	\$21,941,500	\$-21,941,500	1.07238	\$23,529,600	\$-23,529,600
0	32,912,300	-32,912,300	1.	32,912,300	-32,912,300
1	308,000	9,508,900	.8696	267,800	8,268,900
2	308,000	9,508,900	.7561	232,900	7,189,700
3	308,000	9,508,900	.6575	202,500	6,252,100
4	308,000	9,508,900	.5718	176,100	5,437,200
5	747,500	9,069,400	.4972	371,700	4,509,300
6	308,000	9,508,900	.4323	133,100	4,110,700
7	308,000	9,508,900	.3759	115,800	3,574,400
8	308,000	9,508,900	.3269	100,700	3,108,500
9	308,000	9,508,900	.2843	87,600	2,703,400
10	19,433,500	-9,616,600	.2472	4,804,000	-2,377,200
11	308,000	9,508,900	.2149	66,200	2,043,500
12	308,000	9,508,900	.1869	57,600	1,777,200
13	308,000	9,508,900	.1625	50,100	1,545,200
14	308,000	9,508,900	.1413	43,500	1,343,600
15	747,500	9,069,400	.1229	91,900	1,114,600
16	308,000	9,508,900	.1069	32,900	1,016,500
17	308,000	9,508,900	.0929	28,600	883,400
18	308,000	9,508,900	.0808	24,900	768,300
19	308,000	9,508,900	.0703	21,700	668,500
20	-31,222,300	41,039,200	.0611	-1,907,700	2,507,500
				61,443,800	3,400

TABLE C-9. - Discounted cash flow, 3.18-MM-tpy mine

15 percent - 20 years

$$R = \$61,443,800 \div 6.259^1 = \$9,816,900$$

$$\text{less depreciation} \quad 2,474,500$$

$$\text{Depletion + net profit} = \underline{7,342,400}$$

Depletion = 10 percent of sales

Federal income tax = net profit

Depletion + net profit = cash flow - depreciation

$$\text{Sales} = 1/0.55 (1/2 \text{ operating cost} + \text{cash flow} - \text{depreciation})$$

$$= 1/0.55 (12,994,100 + 7,342,400)$$

Sales.....	\$36,975,500
Operating cost.....	25,988,100
Gross profit.....	<u>10,987,400</u>
Depletion.....	3,697,600
Taxable income.....	<u>7,289,800</u>
Federal income tax.....	3,644,900
Net profit.....	<u>3,644,900</u>

$$\text{Annual cash flow} = \text{net profit} + \text{depreciation} + \text{depletion}$$

$$= \$3,644,900 + \$2,474,500 + \$3,697,600$$

$$= \$9,817,000$$

$$\text{Selling price per ton} = \$36,975,500 \div 3,178,600 = \$11.63$$

¹Uniform series present worth factor.

APPENDIX D.--4.99-MM-TPY MINE

TABLE D-1. - Capital investment summary, 4.99-MM-tpy mine

Item	Quantity	Total cost
Continuous miner.....	26	\$7,841,600
Loading machine.....	26	2,095,600
Shuttle car.....	52	3,853,200
Roof bolter.....	26	1,385,800
Ratio feeder.....	26	1,170,000
Auxiliary fan.....	26	98,800
Mantrip Jeep.....	26	455,000
Mechanic Jeep.....	10	138,000
Personnel Jeep.....	10	125,000
Trickle rock duster.....	26	114,400
Triple duty rock duster.....	15	580,500
Supply motor.....	8	250,400
Supply car.....	100	310,000
42-inch rope-type mainline belt conveyor.....	9,000 ft	720,000
36-inch rope-type secondary and panel belts..	60,000 ft	4,020,000
Mainline belt power center (300 kV-A).....	6	112,800
Section belt power center (150 kV-A).....	16	200,000
Section power center (1,000 kV-A).....	26	748,800
Section rectifier (200 kW).....	26	65,000
Section switch house.....	26	244,400
Sectionalizing switch house.....	12	112,800
HV cable (300 MCM AL).....	21,000 ft	210,000
PLM coupler.....	22	22,000
Section cable and coupler.....	-	136,500
Rectifier for track haulage.....	5	125,000
Trolley wire.....	69,000 ft	216,000
Track (60-lb).....	69,000 ft	690,000
Fresh water line.....	69,000 ft	258,800
Pumps and lines.....	-	44,000
Telephone (page phones).....	-	18,000
Conveyor fire protection.....	-	38,000
Automatic controls and alarms.....	-	125,000
Scoop tractor.....	26	910,000
Battery charger.....	26	96,200
All service mask.....	36	3,600
Breathing apparatus.....	50	40,000
Self rescuer.....	950	35,700
Stretcher set.....	40	8,000
Safety light.....	600	26,400
Methanometer.....	600	240,000
Fire chemical car.....	15	57,000
Lamp (including accessories).....	950	49,400
Dust sampler.....	75	30,000
Site preparation.....	-	75,000
Ventilation fan (dual).....	-	120,000

TABLE D-1. - Capital investment summary, 4.99-MM-tpy mine - Continued

Item	Quantity	Total cost
Concrete portal.....	5	75,000
Bulk rock dust facility.....	1	56,300
Substation and distribution.....	1	110,000
Bathhouse, office, and lamp house.....	1	687,500
Shop and warehouse.....	1	437,500
Powder and cap house.....	1	11,300
Front-end loader.....	1	63,000
Forklift.....	1	44,000
Bulldozer.....	1	100,000
Utility truck.....	2	18,000
Pickup truck.....	3	18,000
Oil storage.....	1	38,000
Water tank.....	1	25,000
Supply yard.....	1	25,000
Mine drainage treatment plant.....	-	37,500
Exploration.....	-	312,500
Total direct.....		30,275,300
Field indirect.....		605,500
Total construction.....		30,880,800
Engineering.....		617,600
Overhead and administration.....		1,574,900
		33,073,300
Contingency.....		4,961,000
		38,034,300
Fee.....		760,700
		38,795,000
Estimated development cost.....		23,177,000
		61,972,000
Interest during development.....		3,098,600
Gross estimate.....		65,070,600
Credit for coal mined during development at \$10 per ton...		30,528,000
		34,542,600
Land acquired at \$2,500 per acre.....		40,570,000
Net estimate.....		75,112,600

TABLE D-2. - Manning table, 4.99-MM-tpy mine

Personnel	Total	Wages ¹ per day	Cost per year	Cost per ton
Underground:				
Continuous miner operator....	66	\$55.00	\$812,144	
Loading machine operator.....	66	51.98	768,750	
Machine operator helper.....	66	51.98	768,750	
Shuttle car operator.....	132	49.23	1,456,760	
Roof bolter.....	132	55.00	1,624,288	
Bratticeman.....	66	47.03	696,427	
Utility man.....	66	49.23	728,380	
Mechanic (section).....	66	55.00	812,144	
	660		7,667,643	\$1.53
Supply motorman.....	24	47.58	256,150	
Beltman.....	45	47.03	474,837	
Trackman.....	18	47.03	189,936	
Wireman.....	18	47.03	189,936	
Mason (precision).....	30	49.23	331,078	
Pumper.....	6	47.03	63,311	
Utility crew.....	36	49.23	397,293	
Roving mechanic.....	18	55.00	220,704	
Fireboss (union).....	6	55.00	73,832	
	201		2,197,077	.44
Outside:				
Lampman.....	6	45.38	61,136	
Front-end loader operator....	3	47.85	32,197	
Shop mechanic.....	18	49.50	199,716	
	27		293,049	.06
Salary:				
Superintendent.....	1	-	30,000	
Assistant superintendent....	2	-	48,400	
General mine foreman.....	2	-	40,000	
Assistant mine foreman.....	3	-	48,000	
Section foreman.....	66	-	924,000	
Maintenance superintendent...	1	-	21,800	
General shop foreman.....	2	-	30,400	
Mine maintenance foreman....	3	-	45,000	
Chief mine engineer.....	1	-	22,500	
Draftsman.....	2	-	18,400	
Survey crew.....	6	-	59,400	
Safety director.....	1	-	19,800	
Safety inspector.....	3	-	43,500	
Dust sampler.....	6	-	63,000	
Office manager.....	1	-	15,800	
Timekeeper and bookkeeper....	2	-	22,000	
Purchasing supervisor.....	1	-	15,800	
Warehouseman.....	6	-	59,400	
	109		1,527,200	.31
Total labor and supervision	997		11,685,000	2.34

¹Figures in this column are for the day shift. Shift differentials for other shifts are reflected in the final column.

TABLE D-3. - Depreciation schedule, 4.99-MM-tpy mine

Item	Straight-line depreciation, years	Yearly charge, dollars
Exploration.....	20	15,600
Mine drainage treatment plant.....	10	3,800
Supply yard.....	10	2,500
Water tank.....	10	2,500
Oil storage.....	10	3,800
Pickup truck.....	5	3,600
Utility truck.....	5	3,600
Bulldozer.....	10	10,000
Forklift.....	10	4,400
Front-end loader.....	10	6,300
Powder and cap house.....	10	1,100
Shop and warehouse.....	20	21,900
Bathhouse, office, and lamp house...	20	34,400
Substation.....	20	5,500
Bulk rock dust facility.....	10	5,600
Concrete portals.....	20	3,800
Ventilation fan.....	20	6,000
Site preparation.....	20	3,800
Coal mine safety equipment.....	5	130,600
Underground equipment.....	10	2,736,900
Interim equipment replacement.....	20	456,000
Subtotal.....		3,461,700
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, cost of development, and interest during development, less credit for coal mined at \$10 per ton.....	20	213,400
Total.....		13,675,100

¹\$0.74 per ton.

TABLE D-4. - Power and water cost, 4.99-MM-tpy mine

Number of units	Operation	Hp per unit	Hp, total load	Hp per day, full load	KW, total load	Total kW-hr requirement
22	Continuous miner..	600	13,200	15	9,847	147,705
22	Loading machine...	160	3,520	15	2,626	39,390
44	Shuttle car.....	135	5,940	15	4,431	66,465
22	Roof bolter.....	50	1,100	18	821	14,778
22	Ratio feeder.....	125	2,750	15	2,052	30,780
22	Auxiliary fan.....	30	660	18	492	8,856
22	Mantrip Jeep.....	15	330	6	246	1,476
10	Mechanic Jeep.....	15	150	15	112	1,680
10	Personnel Jeep....	7.5	75	15	56	840
22	Rock duster.....	30	660	12	492	5,904
8	Supply motor.....	80	640	12	477	5,724
3	42-inch conveyor..	300	900	15	671	10,065
20	36-inch conveyor..	150	1,200	15	895	13,425
1	Ventilation fan...		500	24	373	8,952
	Extra for pumps, tools, lights, etc.		700	10	522	5,220
Total.....						361,260

NOTE. - Power: $\$0.02 \times 361,260 \times 220 = \$1,589,500 \div 4,994,900$
 $= \$0.32$ per ton.

Water: 3,000 gal per unit per shift at \$0.10 per M gal
 $= 3,000 \times 22 \times 3 \times 220 \times 0.10 \div 1,000 = \$4,400.$

TABLE D-5. - Estimated annual production cost, 4.99-MM-tpy mine

	Annual cost	Cost per ton
Direct cost:		
Production:		
Labor.....	\$8,925,200	\$1.79
Supervision.....	1,430,000	.29
	<u>10,355,200</u>	<u>2.08</u>
Maintenance:		
Labor.....	1,232,600	.25
Supervision.....	97,200	.02
	<u>1,329,800</u>	<u>.27</u>
Operating supplies:		
Mining machine parts.....	3,150,000	.63
Lubrication and hydraulic oil.....	1,250,000	.25
Roof bolts and timber.....	1,550,000	.31
Rock dust.....	650,000	.13
Ventilation.....	950,000	.19
Bits.....	600,000	.12
Cables.....	300,000	.06
Miscellaneous.....	750,000	.15
	<u>9,200,000</u>	<u>1.84</u>
Power.....	1,589,500	.32
Water.....	4,400	
Payroll overhead (40 percent of payroll).	4,674,000	.93
Union welfare ¹	5,099,200	1.02
Indirect cost:		
15 percent of labor, supervision, and supplies.....	3,132,800	.63
Fixed cost:		
Taxes and insurance, 2 percent of mine cost.....	1,440,300	.29
Depreciation.....	3,675,100	.74
	<u>5,115,400</u>	<u>1.03</u>
Total.....	<u>40,500,300</u>	<u>8.12</u>

¹Effective Dec. 6, 1974, under the Bituminous Wage Agreement of 1974.

TABLE D-6. - Estimated development cost¹, 4.99-MM-tpy mine

Item	Total cost	Cost per ton
Total labor and supervision.....	\$8,615,200	\$2.82
Operating supplies.....	3,510,700	1.15
Power.....	763,200	.25
Payroll overhead.....	3,419,100	1.12
Union welfare.....	3,113,900	1.02
Indirect cost.....	1,770,600	.58
Fixed cost.....	1,984,300	.65
Total.....	23,177,000	7.59

¹Estimated development cost covers the period of time required to place all units in operation within the projected mining plan.

NOTE. - Cost per ton = \$7.59.

Tonnage = 3,052,800.

Credit for coal mined at \$10 per ton = \$30,528,000.

TABLE D-7. - Estimated working capital and total capital investment,
4.99-MM-tpy mine

Estimated working capital:

Direct labor.....3 months...	\$2,921,300
Operating supplies.....3 months...	2,300,000
Payroll overhead.....3 months...	1,168,500
Indirect cost.....4 months...	1,044,300
Fixed cost.....0.5 percent of insurance base...	360,100
Spare parts.....	1,005,700
Miscellaneous.....	115,000
Total working capital.....	8,914,900

Total estimated capital investment:

Total mine cost (insurance, tax base).....	72,014,000
Interest during development.....	3,098,600
Subtotal.....	75,112,600
Working capital.....	8,914,900
Estimated capital investment.....	84,027,500
Estimated deferred capital investment.....	38,956,000
Total capital investment and deferred investment....	¹ 122,983,500

¹This is an average cost of \$24.65 per ton of annual production.

TABLE D-8. - Summary of discounted cash flow, 4.99-MM-tpy mine

Year	Capital investment	Cash flow	Present worth factor at 15 percent	Present worth capital investment at 15 percent	Present worth cash flow value at 15 percent
-1	\$33,611,000	\$-33,611,000	1.15	\$38,652,700	\$-38,652,700
0	50,416,500	50,416,500	1.	50,416,500	-50,416,500
1	456,000	14,939,700	.8696	396,500	12,991,600
2	456,000	14,939,700	.7561	344,800	11,295,900
3	456,000	14,939,700	.6575	299,800	9,822,900
4	456,000	14,939,700	.5718	260,700	8,542,500
5	1,145,000	14,250,700	.4972	569,300	7,085,400
6	456,000	14,939,700	.4323	197,100	6,458,400
7	456,000	14,939,700	.3759	171,400	5,615,800
8	456,000	14,939,700	.3269	149,100	4,883,800
9	456,000	14,939,700	.2843	129,600	4,247,400
10	28,914,000	-13,518,300	.2472	7,147,500	-3,341,700
11	456,000	14,939,700	.2149	98,000	3,210,500
12	456,000	14,939,700	.1869	85,200	2,792,200
13	456,000	14,939,700	.1625	74,100	2,427,700
14	456,000	14,939,700	.1413	64,400	2,111,000
15	1,145,000	14,250,700	.1229	140,700	1,751,400
16	456,000	14,939,700	.1069	48,700	1,597,100
17	456,000	14,939,700	.0929	42,400	1,387,900
18	456,000	14,939,700	.0808	36,800	1,207,100
19	456,000	14,939,700	.0703	32,100	1,050,300
20	-49,028,900	64,424,600	.0611	-2,995,700	3,936,300
				96,361,700	4,300

TABLE D-9. - Discounted cash flow, 4.99-MM-tpy mine

15 percent - 20 years

$$R = \$96,361,700 \div 6.259^1 = \$15,395,700$$

$$\text{less depreciation} \quad \underline{3,675,100}$$

$$\text{Depletion + net profit} = \underline{11,720,600}$$

Depletion = 10 percent of sales

Federal income tax = net profit

Depletion + net profit = cash flow - depreciation

$$\text{Sales} = 1/0.55 (1/2 \text{ operating cost} + \text{cash flow} - \text{depreciation})$$

$$= 1/0.55 (20,250,150 + 11,720,600)$$

Sales.....	\$58,128,600
Operating cost.....	<u>40,500,300</u>
Gross profit.....	17,628,300
Depletion.....	<u>5,812,900</u>
Taxable income.....	11,815,400
Federal income tax.....	<u>5,907,700</u>
Net profit.....	5,907,700

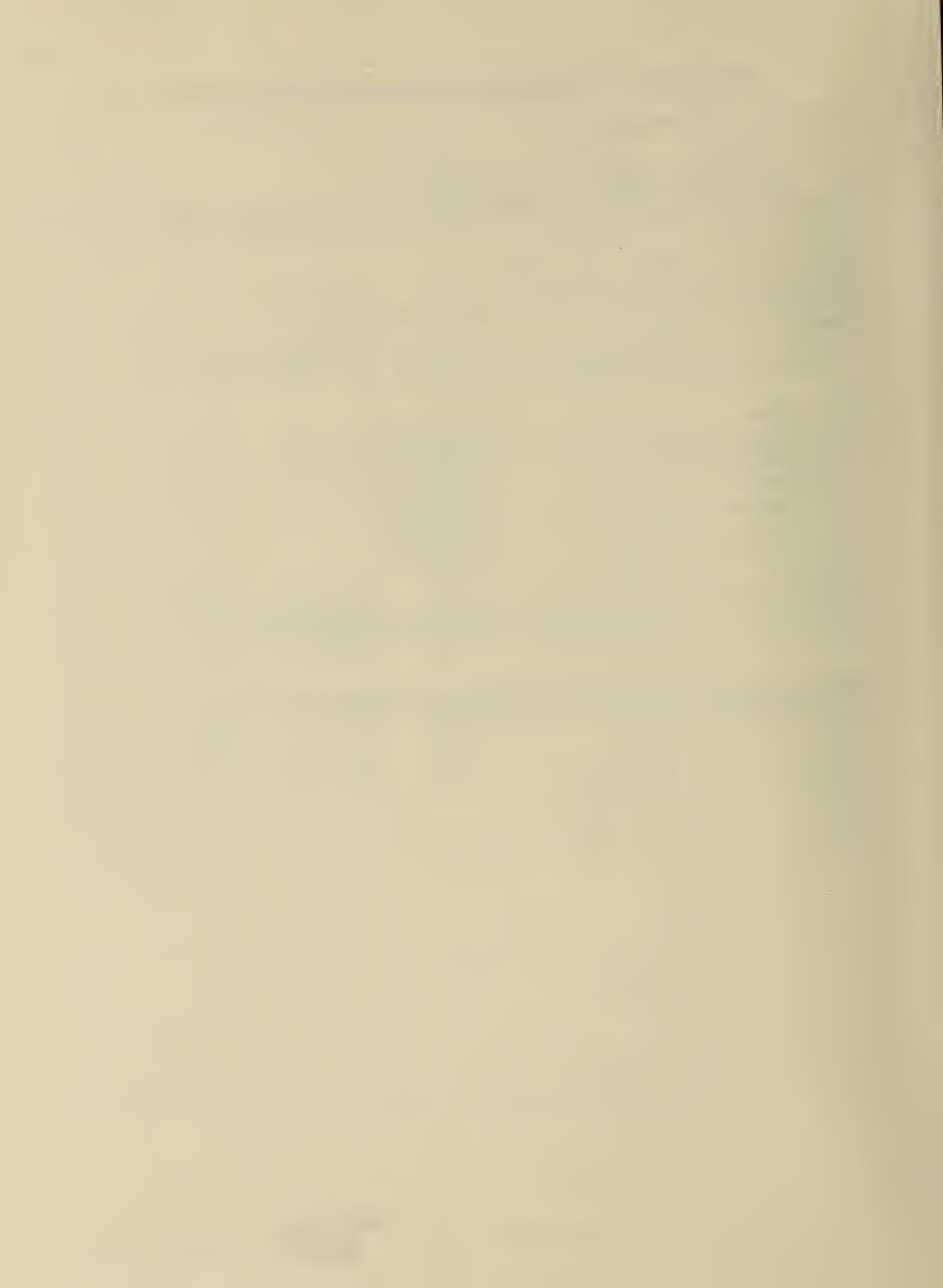
$$\text{Annual cash flow} = \text{net profit} + \text{depletion} + \text{depreciation}$$

$$= \$5,907,700 + \$5,812,900 + \$3,675,100$$

$$= \$15,395,700$$

$$\text{Selling price per ton} = \$58,128,600 \div 4,994,900 = \$11.64$$

¹Uniform series present worth factor.









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